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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/629,240	07/29/2003	Andreas Molisch	MERL-1478	6607

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EXAMINER
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ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/629,240	MOLISCH ET AL.	
	Examiner	Art Unit	
	Adolf DSouza	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 June 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 - 11,13-15* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 July 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Response to Arguments

1. Applicant's arguments with respect to claims 1 - 15 have been considered but are moot in view of the new ground(s) of rejection.

Claims 1 – 15 were previously allowed if rewritten to overcome the objections. The allowability is being withdrawn in view of the new ground(s) of rejection.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the transmit and receive antennas (claim 1) and the summing of the weighted data streams (claim 2) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for

consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claims 1 –4, 6 – 7 are objected to because of the following informalities: L_r and L_t are not clear in the claims. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1 – 3, 6 – 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Gore et al.** (MIMO Antenna Subset Selection With Space-Time Coding; which has been provided by the Applicant in his IDS) in view of **Abdul Aziz et al.** (Indoor

throughput and range improvements using standard compliant AP antenna diversity in IEEE 802.11a and ETSI HIPERLAN/2; VTC 2001; 7-11 Oct. 2001; pages 2294 – 2298).

Regarding claim 1, Gore discloses:

a method for processing radio frequency (RF) 2 signals in a multi-antenna system (Fig. 1; page 2581, section II, 1st paragraph) comprising:

generating L_t input data streams in a transmitter, where L_t is an integer (Fig. 1; page 2581, section II);

modulating the L_t input data streams to RF signals (Fig. 1; page 2581, section II);

switching the RF signals to t RF branches by a t x t matrix multiplication operator Φ_1 whose output are t RF signals (Fig.1, element "switch");

transmitting the t RF signals over a channel by t transmit antennas (Fig. 1 wherein the t antennas are shown as K_T antennas);

receiving the transmitted signals by r antennas in a receiver, where r is an integer (Fig.1, wherein the r antennas are the K_R antennas);

selecting L_r branches from r streams; demodulating the L_r signal streams; processing the demodulated streams L_r signal streams in baseband to recover output data streams corresponding to the input data streams (Fig. 1; section II).

Gore does not disclose applying a phase shift transformation.

In the same field of endeavor, however Abdul Aziz discloses applying a phase-shift transformation to the r RF signals by a r × r matrix multiplication operator Φ_2 to

generate r streams (Fig. 3, element "diversity weighting"; page 2295, section III, 1st 2 paragraphs; page 2295, right column, paragraph starting with "In Fig. 3, two signal streams ..."; wherein the phase shift transformation is interpreted as the phase compensation).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the phase compensation technique, as taught by Abdul Aziz, in the system of Gore because this would allow the phases of two or more spatially separated signals to be manipulated to ensure their constructive compensation at the receiver, as disclosed by Abdul Aziz (page 2295, section III, 2nd paragraph).

Regarding claim 2, Gore discloses each of the L_t input data stream, has a weight (Fig. 1, element "diversity weighting" which weights the streams according to the channel state information) and further comprising summing the L_r weighted data streams before the demodulating and decoding (Fig. 6, element "diversity combination"; which weights and combines the streams).

Regarding claim 3, Gore discloses the L_t input data streams are generated by a space-time block coder (Title; Abstract; page 2580, right column, 1st paragraph in "Contributions and Organization of Paper").

Regarding claims 6 - 7, Gore discloses the matrices Φ_1 and Φ_2 are identity matrices (Fig. 1; wherein having an identity matrix is equivalent to not having any phase transformation at all).

Regarding claims 8 - 9, Gore does not disclose constant modulus phase only terms.

In the same field of endeavor, however Abdul Aziz discloses Φ_1 and Φ_2 have phase only terms (page 2295, section III, 1st 2 paragraphs; also page 2295, right column, text above Fig. 4; Fig. 3).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the phase compensation technique, as taught by Abdul Aziz, in the system of Gore because this would allow the phases of two or more spatially separated signals to be manipulated to ensure their constructive compensation at the receiver, as disclosed by Abdul Aziz (page 2295, section III, 2nd paragraph).

Claims 8 – 9 are rejected twice, the 2nd time appearing later in the Office Action.

Claim 10 is similarly analyzed as claims 8 – 9.

Regarding claim 11, Gore does not disclose instantaneous channel estimate.

In the same field of endeavor, however Abdul Aziz discloses the phase-only terms adapt to an estimate of an instantaneous channel state (page 2295, right column,

paragraph starting with "In Fig. 3, ..."; wherein the instantaneous channel state is the CSI vector extracted from the most recently received UL transmission).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the phase compensation technique, as taught by Abdul Aziz, in the system of Gore because this would allow the phases of two or more spatially separated signals to be manipulated to ensure their constructive compensation at the receiver, as disclosed by Abdul Aziz (page 2295, section III, 2nd paragraph).

6. Claims 4 - 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Gore et al.** (MIMO Antenna Subset Selection With Space-Time Coding; which has been provided by the Applicant in his IDS) in view of **Abdul Aziz et al.** (Indoor throughput and range improvements using standard compliant AP antenna diversity in IEEE 802.11a and ETSI HIPERLAN/2; VTC 2001; 7-11 Oct. 2001; pages 2294 – 2298) and further in view of **Kitchener et al.** (US 20020085643).

Regarding claims 4 – 5, Gore does not disclose space-time trellis coder and space-time layered structures.

In the same field of endeavor, however Kitchener discloses space-time trellis coder and space-time layered structures (paragraph 5; Fig. 19; paragraph 94).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Kitchener, in the system of

Gore because this would allow the benefits of space-time coding to be utilized, namely lower bit error rates, as is well known in the art.

7. Claims 8 – 9, 13 - 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Gore et al.** (MIMO Antenna Subset Selection With Space-Time Coding; which has been provided by the Applicant in his IDS) in view of **Abdul Aziz et al.** (Indoor throughput and range improvements using standard compliant AP antenna diversity in IEEE 802.11a and ETSI HIPERLAN/2; VTC 2001; 7-11 Oct. 2001; pages 2294 – 2298) and further in view of **Auer et al.** (Channel estimation for OFDM systems with multiple transmit antennas by exploiting the properties of the discrete Fourier transform; PIMRC 2003; 7-10 Sept. 2003 Pages 1954 - 1958).

Regarding claims 8 - 9, Gore does not disclose constant modulus phase only terms.

In the same field of endeavor, however Auer discloses Φ_1 and Φ_2 have phase only terms (Abstract; page 1954, right column, up to start of section II; page 1956, right column, section C, 1st 2 paragraphs; wherein the constant modulus phase is the exponential functions of the discrete Fourier transform).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the phase compensation technique, as taught by Auer, in the system of Gore because this would allow the superimposed signals to be

separated by performing an IDFT, as disclosed by Auer (page 1954, right column, middle of paragraph).

Regarding claims 13 - 15, Gore does not disclose the Φ_1 and Φ_2 matrices are fast Fourier transform matrices.

In the same field of endeavor, however Auer discloses the Φ_1 and Φ_2 matrices are fast Fourier transform matrices (Abstract; page 1954, right column, up to start of section II; page 1956, right column, section C, 1st 2 paragraphs).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the phase compensation technique, as taught by Auer, in the system of Gore because this would allow the superimposed signals to be separated by performing an IDFT, as disclosed by Auer (page 1954, right column, middle of paragraph).

Allowable Subject Matter

8. Claim 12 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Other Prior Art Cited

9. The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to space-time coding:

Calderbank et al. (US 6,127,971) discloses Combined array processing and space-time coding.

El - Gamal et al. (US 20020122502) discloses a method and system for utilizing space-time overlays for convolutionally coded systems.

El - Gamal et al. (US 20020141508) discloses a space-time trellis code for orthogonal frequency division multiplexing (OFDM).

Berthet et al. (US 20020168017) discloses a method and system of iterative coding/decoding of digital data streams coded by spatio-temporal combinations, in multiple transmission and reception.

Contact Information

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Adolf DSouza whose telephone number is 571-272-

1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Adolf DSouza
Examiner
Art Unit 2611

AD

DAVID C. PAYNE
SUPERVISORY PATENT EXAMINER